Worksheet 3 Iteration Answers

Task 1

1. Complete the trace table to determine the purpose of the following algorithm. Test it with input 14 and 5.

```
x = input ("Enter the first integer: ")
y = input ("Enter the second integer: ")
z = 0
while x > 0
   if x mod 2 == 1 then
      z = z + y
   endif
   x = x div 2
   y = y * 2
endwhile
print ("Answer =", z)
```

x	y	x mod 2	z	x > 0	output
14	5	0	0	True	
7	10	1	10	True	
3	20	1	30		
1	40	1	70	True	
0	80			False	Answer = 70

The purpose of the algorithm is to multiply two integers.
It is known as the “Russian peasant’s algorithm”. Students can look it up on the Internet to find out why it works!

See Python program W3 Qu1 Russian peasants algorithm.py in folder.

Get students to code the program and try it out with different integers.

2. A doctor records a patient's temperature once an hour for six hours. Any time the temperature is > 37C, an incidence of fever is recorded.

   The average temperature is calculated at the end.

   (a) Calculate the expected result using test data 36, 36, 38.5, 37, 38, 36. Ans: 36.9

   (b) Complete the trace table using the pseudocode below for this data.

```
temp = 0
fever = 0
total = 0
hour = 1    ******************change to hour = 0
while hour < 7      **********change to while hour < 6
    temp = input("Enter temperature: ")
    if temp > 37 then
        fever = fever + 1
    endif
    total = total + temp
    hour = hour + 1
endwhile
average = round(total/hour,1) #round to 1 decimal place
print("Average temperature:", average)
print("Incidents of fever:", fever)
```

temp	fever	total	hour	average	Output
0	0	0	1	0	
36		36	2		
36		72	3		
38.5	1	110.5	4		
37		147.5	5		
38	2	185.5	6		
36		221.5	7	31.6	
(0)					"Average temperature: 31.6"
					"Incidents of fever: 2"

   (c) Is the result correct? If not, make changes to the pseudocode so that it gives the correct result. No – need to make changes shown with ***** above.

(d) Rewrite the pseudocode from the task above to include a range check to ensure that a temperature is between 30 and 44. Produce an error message for invalid data. The program should allow the user to re-enter the temperature if it is out of range.

```
temp = 0
fever = 0
total = 0
hour = 0
while hour < 6
   temp = input("Enter temperature")
   while temp <  30 OR temp  > 44
      temp = input("Invalid data: please re-enter")
   endwhile
   if temp > 37 then
      fever = fever + 1
   endif
   total = total + temp
   hour = hour + 1
endwhile
average = total/hour
print("Average temperature: ", average)
print("Incidents of fever ", fever)
```

Task 2

3. A parts supply company uses 4-digit part numbers. The last digit indicates the production run. If the production run is 6,7 or 8 it is considered to be an old model.

   Write a pseudocode algorithm that prompts the user to enter a part number.

   The length of the part number should be equal to 4 digits, otherwise an error message will be displayed and the user will be prompted to input the part number again.

   The algorithm should count the the total number of parts entered and the number of old model parts and output these totals.

   Data input will terminate when the user inputs 9999.

```
Using a WHILE loop:
oldModel = 0
total = 0
partnum = input("Enter part num: ")
while partnum <> "9999"
   while len(partnum) <> 4
      partnum = input( "Error: enter 4 digit number: ")
   endwhile
   if partnum[4] >= "6" AND partnum[4] <= "8" then
      oldModel =oldModel + 1
   endif
   total = total + 1
   partnum = input ("Enter part num: ")
endwhile
print ("Number of old models: " , oldModel)
print ("Total number of parts", total

or using a do loop:
oldModel = 0
total = 0
do
   partnum = input("Enter part num: ")
   if  partnum != "9999" then
      if len(partnum) != 4 then
         repeat
            partnum = input("Error: enter 4 digit number: ")
         until len(partnum) == 4
      endif
      if partnum[4] >= "6" AND partnum[4] <= "8" then
         oldModel =oldModel + 1
      endif
      total = total + 1
   endif
until partNum == "9999"
print ("Number of old models: " , oldModel)
print ("Total number of parts", total
```

4, What is a common cause of an accidental infinite loop?
Forgetting to allow the data that will affect the termination value to change inside the loop, either through a calculation or through reading in user data.

Task 3

5. A teacher has a class of 30 pupils. Each pupil has taken 3 tests during the year. The teacher needs to know the average class score for test1, test2 and test3. She also needs to know the overall average test score for the year. Write an algorithm in pseudocode that will allow the teacher to input all results and print this information.

```
test1 = 0
test2 = 0
test3 = 0
total1 = 0
total2 = 0
total3 = 0
totalYear = 0
for index = 1 to 30
    test1 = input("Enter test 1 score: ")
    test2 = input("Enter test 2 score: ")
    test3 = input("Enter test 3 score: ")
    total1 = total1 + test1
    total2 = total2 + test2
    total3 = total3 + test3
next index
totalYear = total1 + total2 + total3
average1 = total1/30
average2 = total2/30
average3 = total3/30
averageYear = totalYear/30
print("Averages:", average1, average2, average3, averageYear)
```

6. A Hallowe'en display needs a computer controlled light which will flicker. Flicker the light for a random number of seconds between 1/10 and 1/100 of a second. You can use a **pause** function that takes as a parameter the number of milliseconds to pause the program. For example **pause(1000)** will pause the program for 1 second. To turn the light on and off set the value of light to HIGH for ON and LOW for OFF. The control loop should run continuously.

```
x = 1
while x == 1
    light = HIGH
    pause (random (10, 100))
    light = LOW
    pause (random (10, 100))
```

```
endwhile
```